

Amendment under 37 C.F.R. § 1.111
Serial No. 10/721,870
Attorney Docket No. 032136

REMARKS

Claims 1-36 are pending. Claims 10-18 are allowed. Claims 2, 4, 5, 6, 8, 21, 22, 25 and 30 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form. Claim 36 has been added herein. Support for the new claim is found at page 11, lines 9-11 of the application.

Applicants' Response to the Claim Rejections under 35 U.S.C. §103

Claims 1 and 9 stand rejected under 35 U.S.C. §103 as being unpatentable over Heo et al. (US 2004/0171271A1) in view of Park et al. (US 2001/0041421A1). Applicants respectfully traverse. In order for a combination of references to be obvious, there must be a teaching, suggestion or motivation to make the combination. The combination is not obvious if there is a teaching away in the cited references. In the present case, applicants submit that there is a teaching away. Specifically, Heo and Park are utilizing the silicon nitride layer for distinct and uncombinable reasons.

First, the Office Action states that Heo et al. is silent as to the thickness of the silicon nitride layer. Applicants respectfully submit that Heo describes the nitride liner 150 as being 3-14 nm. The thickness is chosen to prevent the diffusion of impurities and minimize the effect of the nitride liner 150 with respect to the aspect ratio of the first trench 131. See paragraph [0035]. The nitride liner 150 protects the oxide layer 140 throughout the process. See Figs. 9 and 10. The shoulder of the substrate remains covered by the nitride liner. This is contrary to the teaching of Park.

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The liner 50 of Park must be recessed into the trench 47 to form a “dent.” The dent increases oxidation of the upper edge of the trench. See paragraph [0050]. Park forms a silicon nitride layer 50 of 2-20 nm. See paragraph [0046]. The semiconductor substrate 40 is not oxidized by the protection of the nitride liner 50 in the densification process. See paragraph [0048]. When the pad nitride film is removed by hot phosphoric acid, over-etching is performed to form the “dent” in the nitride film liner 50 to allow increased oxidation at upper the edge of the silicon substrate defined by the trench. See paragraph [0050].

Therefore, one skilled in the art would not be motivated to make the combination of the references because Heo requires the nitride layer remain over the shoulder while Park requires that the nitride layer is over etched. Wherefore, favorable reconsideration is respectfully requested.

Claim 7 stands rejected as being unpatentable over Heo et al. in view of Park et al. as applied to claim 1, and further in view of Vassiliev et al. (U.S. Patent No. 6,180,490B1). Applicants respectfully submit that claim 7 depends from claim 1, and by addressing the rejection to claim 1, the rejection to claim 7 is likewise addressed.

Claims 19-21, 23-29 and 31-35 stand rejected as being unpatentable over Heo et al. in view of Park et al. as applied to claim 1, and further in view of Laxman et al. (U.S. Patent No. 5,874,368) and further in view of Liu et al. (6,590,271B2). Applicant’s claim 19 recites “(d) forming a second liner insulating layer of carbon-containing silicon nitride over said first line insulating layer”. Claims 24 and 29 also require carbon present in the silicon nitride layer. The

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Office Action maintains that this limitation is taught by Laxman et al. Applicants respectfully traverse as follows.

The Office Action maintains that “nonpreferred embodiments constitute prior art.” See page 2 of the current Office Action (emphasis added). However, applicants respectfully submit that the disclosures including carbon in Laxman are not embodiments, but negative disclosures to which all taught embodiments of Laxman are supposedly superior. The law to which the Office Action cites is directed to lesser variants of the taught invention of the prior art. In other words, if Laxman taught a carbon containing embodiment but a preferred non-carbon containing second embodiment, the carbon embodiment would be combinable prior art.

However, Laxman teaches that carbon containing films are all inferior to all of Laxman’s embodiments precisely because they contain carbon. Therefore, the disclosure in Laxman is not an embodiment and the reference teaches away from the utilization of carbon in the nitride liner. Specifically, table 1 of Laxman at col. 5, lines 1-33 only teaches a single precursor of those listed as an embodiment and it states that the embodiment has no carbon contaminations. Therefore, applicants respectfully submit that one of ordinary skill in the art would not have found it obvious to make the combination from the references because Laxman clearly teaches away from applicants’ invention.

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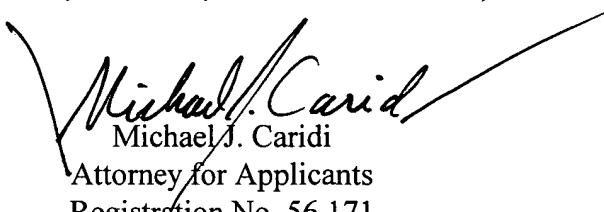
In view of the aforementioned amendments and accompanying remarks, Applicants submit that the claims, as herein amended, are in condition for allowance. Applicants request such action at an early date.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney to arrange for an interview to expedite the disposition of this case.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

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